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IMPORTANT PROBLEMS IN THE AUTOMATION OF RADIO TRANSMITTING EQUIPMENT

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The July Plenum of the TsK KPSS [Central Committee of the Communist Party of the Soviet Union] pointed to the need for extensive complex mechanization and automatization of production processes, for the daily introduction of new techniques, and for the improvement of the organization of production.

Automatization of production processes is a mighty means for increasing the productivity of labor. Under the conditions at radio enterprises automatization permits release of a considerable number of highly skilled workers. Moreover, it sharply reduces the need for unskilled labor, which permits a decrease in expenditures for construction of radio stations due to a reduction in housing needs for workers. On the other hand, with automatization the demands upon the remaining personnel are considerably increased and they are able to use their knowledge to the fullest extent, being occupied in setting up adjusting equipment which operates for long periods without observation.

The necessity for the most rapid introduction of automatization is now universally recognized. However, the introduction of automatization in the field of radio is progressing extremely slowly. Until the present time there has not been a single experimental installation in operation without continuous supervision.

Why is automatic operation not being introduced at radio enterprises? It is clearly impossible to attempt to solve this important problem by one-sided measures. It is necessary to prescribe and carry out a number of measures, calling upon the scientific research institutes of communications, planning institutes, design bureaus of industry, and operational services to join in their execution.

The introduction of automatization must be carried out simultaneously in a number of directions. In one case it may be conveniently restricted in the first stage to partial automatization in order to decrease the number of posts of shift personnel. In another case a changeover may be made from a constant shift at the enterprise to duty at home when the personnel live close to the station and appear at it only upon receiving a warning signal. Finally, with full automatization personnel are at the station only periodically in order to perform inspections or eliminate faults.

For solution of the problems of automatization the scientific research institutes must develop circuits for remote control and remote supervision in the operation of unattended equipment. Moreover, it is neccessary to solve the problem of mutual reservation of one part or another of the equipment, to insure the possibility of automatic maintenance of the operating conditions of transmitters and receivers by introducing circuits for automatic alignment, to provide for rapid automatic localization of faults, etc.

Modern electrical engineering and electronics have developed a great number of instruments and various remote-controlled circuits which are widely used in the different branches of industrial production. Many of them are already in use at radio stations. Semiconductor devices are especially suited for use in multi-tube monitoring and measuring units. It is also impossible to overlook the new perspectives opened by the development of television and possibilities for using radioactive isotopes. It is now necessary to examine the expediency of using new instruments in designing transmitter installations. For example, the difficulty in creating "gidroknopki" [hydraulic pushbuttons?] which are reliable in operation. The existing instruments whose principle of operation is based on calculation of absorption of the water of radioactive particles may successfully replace the gidroknopki presently in use. Similar instruments may be made for determination of the amount of water in a closed system, the extent of scale deposits on the walls of tanks. Wide application may be found for instruments using radioactive isotopes for the measurement of the level of water and oil in oil fields and reservoirs A simple addition to the instrument in all cases permits transmission of current to make-and-break relays by means of which the necessary automatic operations are performed. In time, with the aid of such instruments it will be possible to control the quality of oil in transformers and, which is especially important for unattended installations, to determine the degree of wear of vacuum-tubes filaments.

Scientific research institutes must lead the work in creating new, improved circuits and instruments for the automatization of all processes of remote supervision and control.

No less important are the problems confronting industrial design bureaus and design institutes. The transmitters now in production have many elements of automatic control. As a rule, all the transmitters are provided with installations for remote connection and disconnection of individual current sources, ensuring the sequence of operations.

Nevertheless, transmitters of all types are being produced in which the designers make no provisions for complex introduction of automatization, with the result that it is not possible to organize unattended operation of this apparatus. This applies to operations associated with the system of water cooling, with the work of personnel in converting a transmitter from one form of operation to another, in changing operating frequencies, in choosing interstage coupling, etc, as well as to problems of standby operation of individual transmitter elements in case of transmitter failure. Designers must be required to establish conditions which will ensure the possibility of organizing unattended operation.

The most important problem in creating automatized transmitters is the conversion to air-cooled high-power tubes. With the solution of this problem there will no longer be any need for installing complex dual-ring cooling systems with pumps, numerous valves, tanks, etc, which will not only reduce the cost of construction but will also simplify operation. In addition, the use of air-cooled tubes increases the efficiency of the entire installation.

Of no less importance are those projects intended to increase the electrical stability and operational reliability of all elements of the transmitter and auxiliary units.

Successful solution of design problems will permit a considerable decrease in the dimensions and weight of new transmitters and lower the construction costs of the installations on the whole.

Industrial design bureaus must also soon begin work in modernizing the standard equipment in current production. It is primarily necessary to examine the circuits of the transmitters of most recent production. Of course, this will not necessitate complete revision of the schematics, but will entail addition of units eliminating the need for manual operation and protection of the transmitter in the performance of a number of operations. Thus, it is necessary to replace fuses with circuit breakers, to provide constant coupling between stages, to equip transmitters with automatic recording devices, etc. In many cases where modernized transmitters are not fully unattended the work of the shift personnel is considerably lightened and as a consequence part of the personnel is freed from constant attendance.

The work of the design institutes is of great importance for the introduction of automatization. In designing the individual elements of a radio center the principles of complex automatization must be observed. This is sometimes hindered by previous operating instructions which made no provision for automatic attendance of equipment. It is obvious that all instructions containing out-of-date ideas which hinder technical progress must be subject to re-examination. As an example of incorrect planning we may cite those installations with power obtained from isolated substations which require personnel on constant duty. Another example is found in those installations where in the very process of planning the location of equipment and control instruments it is admitted that it will be necessary to establish additional duty posts at distributing frames, at pump units, at low-frequency amplifiers, etc. Hence the proper placement of equipment within a building is of great importance. In these matters the friendly cooperation of the industrial design bureaus and design institutes is necessary.

It is evident that all periodically replaced components and instruments -- tubes, thyratrons, etc -- must be placed in a single room. In order to avoid an inordinate increase in the dimensions of the room it is necessary that all elements not requiring constant attention be located outside it. In modern projects many of the above measures are observed, though in practice equipment requiring the location of personnel in other premises is almost everywhere retained.

In designing antenna systems it is necessary to provide for a reduction in the personnel required to service them. At many centers there are antenna groups working the year round in repairing and reconditioning antenna installations. It is evident that replacement of wooden feeder poles with poles of reinforced concrete, changing the system of hanging the lines, and automatizing antenna switches will somewhat facilitate the operation of an antenna system and decrease the demands upon the work force. In the case of long relay lines the use of radio relay equipment will eliminate the need for line walkers. It is also necessary to revise the organization of dispatcher and control points at large radio centers. The functions of the work shifts of these points often amount to repeating and verifying instructions received from the radio control room. It is necessary to develop and install apparatus which will automatically monitor the operating condition of the transmitter and communicate the readings to the central control room.

Thus, the most pressing problem of the engineering departments of branch administrations, design bureaus, and design institutes is the preparation of technical specifications for new apparatus not requiring constant attendance and for the modernization of equipment in current production in order that it may be placed in semiautomatic operation.

Together the design institutes and design bureaus must determine the best equipment layout and solve the problem of creating the most economical types of structures for radio centers.

A considerable volume of work must be performed by operational enterprises. It is necessary to revise the organization of operation at existing installations and above all to check the use of personnel at radio stations with a consideration of the degree of skill attained by them. For this purpose it is necessary to examine the duties of each shift and to study its production operations. In this way it will be possible to prescribe measures for elimination of constant duty at a number of posts located in isolated premises by removing the instruments of control and supervision to a central room, by installing additional equipment for automatic control, by replacing fuses with circuit breakers, etc. In a number of cases it may also be necessary to relocate part of the equipment. All such measures should be included in the radio station's plan for annual repairs and must be accomplished in the shortest possible time. The execution of these measures in some cases will free a number of workers from shift duty and in other cases will permit the replacement of skilled workers with less-skilled workers.

Moreover, it is necessary to determine the expediency of maintaining at radio centers large repair brigades and shops engaged in the renovation and repair of equipment. In order to restore the communications system so badly damaged during the war it was necessary in the first postwar years to mobilize all available resources. The work of restoration required the services of local operational labor, auxiliary production shops, etc by means of which there was organized the production and repair of equipment in the localities, which permitted the growth of broadcasting and radio communications facilities in the shortest possible time.

It is quite natural that under such conditions known departures from the more rational procedures were permitted, and use was made of equipment of various years of production which was not quite up to technical standards. The result was that the most varied equipment was used in the radio communications system. In recent years it has been possible to replace some of the operated facilities with newer equipment. However, the relative importance of outmoded equipment is still considerable. This equipment does not meet many current requirements both with respect to certain of its operational characteristics and economy and with respect to the number of personnel required to service it.

The use of various equipments also requires considerable reserves of spare parts which often are used at only one enterprise. Such specificity and uniqueness of equipment necessitates the organization of production shops at radio centers. These shops manufacture the lacking parts and equipment. The unprofitableness of these shops is apparent. The irregularity of orders and the manufacture of individual components does not permit the application of modern production methods. The cost of these components is ten and a hundred times greater than the cost of similar items of plant manufacture. Sometimes their manufacture is associated with an order requiring a plant to create, as an example, less than a hundred insulators of a new type or a form for a complex casting to be used one or two times.

There is no doubt that in a number of cases outmoded equipment is kept in operation because of inadequate consideration of the expense of its restoration.

Much of the yearly expenditure on repairs could be more effectively used if part of it was devoted to replacing outmoded equipment with new equipment. If the yearly cost of repairing outmoded equipment is considered, the expedience of such replacement is obvious. It would also be of some use to analyze the yearly activity of the shops and repair brigades at radio centers, determining the output per worker and the cost of components manufactured at enterprises. It may be asserted that after such analysis the necessity for changing the established forms of organization in this field will become apparent. It would clearly be best to designate one of the plants of the Ministry of Communications USSR or of the Ministry of Radio Engineering Industry USSR for the manufacture of replacement parts for existing equipment.

In a number of cases it is convenient to replace large units of outmoded equipment with standard plant-manufactured equipment (for example, the rectifier installations, the filament supply system, etc). Such replacement lowers the cost of operation and facilitates the task of providing radio centers with replacement parts. Moreover, it will not be necessary to store so many replacement parts at each radio center.

It is possible that in certain cases it will be necessary to organize warehouses to provide equipment for all the radio stations of a given rayon. For the economical execution of urgent work it is advantageous to organize individual oblast shops meeting the needs of all communications enterprises.

Special attention must be devoted to matters of technico-economic analysis of the production activity of radio enterprises. Up to the present very little has been done in this field. Notwithstanding the fact that at several radio centers cost accounting has been introduced, systematized data which would permit application of this system at other radio centers are still not available. Nevertheless, the cost of production (in the case under consideration, the cost per hour of transmitter operation, including the cost of maintaining personnel) very rarely varies for installations of the same type. This points up the need for thorough analysis of the activity of radio centers, particularly those centers where costs are especially high. A study of the economic activity of enterprises shows the necessity for replacing obsolete tubes with newer, more economical tubes, the necessity for replacing parts of equipment, etc.

As an example consider the case of a high-power station which in the course of many years requires a considerable amount of water from the municipal water supply; the yearly expenditures for this purpose amount to tens of thousands of rubles. The provision of a spraying reservoir with repeated use of the water has long since justified itself. No less important are the problems of operation of vacuum-tube devices. At the present time the variety of vacuum-tube devices in production is extremely large. Attempts on the part of industry to reduce this list usually encounter resistance on the part of operational organizations not desiring to engage in the reconstruction of equipment and sometimes dreading it. Nonetheless, the new tubes are of higher quality and more economical, though they are at first more expensive due to insufficient mastery of the production process. The high price of the tubes provides operational workers with an excuse for retaining old types of tubes on the basis of economic reasoning. Newer tubes have even been replaced by old tubes as a rationalizing measure.

All this creates an abnormal state of affairs which hinders the introduction of more progressive techniques. It is apparent that in this matter industry must take a firmer stand and also set about reducing the initial cost of new tubes as far as possible. In order to expedite the replacement of tubes at communications enterprises industry is obliged, in addition to producing new tubes, to issue recommendations for the replacement of old tubes indicating the parameters of the new cooling tanks or the necessary reconstruction of existing tanks, giving the specifications of new filament transformers, indicating circuit changes in rectifier units, etc, as well as organizing the production of the necessary components, tanks, transformers, et al. This will considerably facilitate the introduction of new tubes and consequently decrease the variety of tubes in use.

As is seen from the foregoing, the extent of the measures necessary for the introduction of new techniques and for an increase in the productivity of labor at radio centers is considerable. In this connection the role to be played by the engineering departments of the branch administrations is extremely large. Daily, steady work is required of them in introducing new techniques and new production processes. The engineering departments must lead the effort to convert a number of enterprises to semiautomatic or fully automatic operation. They must prepare instructions to serve as guides in modernizing equipment and replacing obsolete tubes; they must create more progressive technical conditions for the development of new types of equipment, pointing out to the plants and institutes the basic directions for the development of new techniques.

The scientific research institutes and design institutes, the design bureaus of industry and communications enterprises must engage in close collaboration in organizing the daily, steady struggle for further technical progress in the radio communications and broadcasting facilities of the Soviet Union.

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